



OTC 18587

Independence Hub—Turnkey Delivery of Ultra Deepwater Hull and Mooring System

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This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

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Abstract

An overview of the major design and construction activities related to the turnkey delivery of a DeepDraft Semi™ hull and mooring system is presented. Activities overviewed include model test, global motions, steel catenary riser (SCR) analysis and design, hull engineering, topside main steel engineering, hull transport and completion. In addition, specific focus topics are identified that receive a more detailed presentation to include hull vortex induced motions, hull air gap during design hurricane events, effects of wave run-up during design hurricane events, topside-to-hull integration interface, multi-cable transits and shipyard safety program.

Introduction

The Independence Hub project is located in Mississippi Canyon Block 920 in approximately 8,000 ft. of water, which is the current world record for a floating production facility.

At the outset and some eight months prior to the securing of the Independence Hub Project, a development program was undertaken to review the critical factors affecting the design of deepwater semi-submersible production facilities. It was recognized early on that the design would be controlled by the SCR design as well as the payload and stability requirements. The idea was to “tune” the hull (greater draft less global motions) until an optimal minimum draft was achieved where the strength and fatigue designs achieved an acceptable level of stress and fatigue life. With the tuned draft in hand, the remainder of the platform could be proportioned for project specific payload and stability requirements.

Secondly, since an advantage of a DeepDraft Semi™ is inshore topside-to-hull integration, it was recognized, due to the relatively shallow draft restriction in port and during the initial stages of tow to the installation site, that integration and tow stability would also be a significant design variable. Once a topside footprint and payload has been estimated or determined, preliminary sizing of pontoons and nodes can be

completed. Finally, column dimensions can then be sized according to the requirements of the integration and tow stability analyses. Several iterations may be required in order to finalize the hull principle dimensions. In the event of changes to the global VCG during the initial stages of detail engineering (hull or topside), VCG corrections can normally be achieved by changes in the column cross-sectional dimensions without changing the topside and pontoon plan dimensions. Once the principle dimensions are finalized, the more detailed analysis work can proceed.

A summary of the principle characteristics for the Independence Hub DeepDraft Semi™ is shown in Figure 1.

Item	Description
<u>Hull</u>	
Dimensions (LWH):	
Overall	232' x 232' x 160'
Pontoon	140 x 38' x 26'
Node	46' x 46' x 26'
Column	46' x 46' x 134'
Draft	105'
Total Payload	19,420 s. t.
Total Displacement	45,830 s. t.
SCR's	1 20" Export & 16 8"/10" Flowlines
<u>Topside</u>	
Dimensions	220 x 140' x 39'
Production	1 BCF

Figure 1 Summary of Principle Characteristics

The scope of work included in the delivery of the hull and moorings was as follows:

- Design, construct, transport and commission a DeepDraft Semi™ hull.
- Global Motions and Global Weight Control.
- Design, procure and deliver the chain/polyester moorings.
- Design, procure and deliver the IMMS system.
- Design of topside main steel and structural integration with hull.